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MONTEREY PINE DIE-BACK (Physiological

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MONTEREY PINE DIE*BACK

Last spring a study of the die-back of the Monterey pine was made a Pt. Lobos State Park in Monterey County south of Carmel. A brief resume will be given of that work, with additional information, to tie in with the study being made of the Monterey pine plantations in the Berkeley and Oakland Hills.

Pitch rings were found in the twigs, branches, and trunks of Monterey pines at Pt. Lobos and also in the Berkeley Hills. This was assumed to be caused by a microscopic insect, fungus, or bacteria, and to be contributory to the weakening of the tree, lowering its resistance and making it an easy prey to insect attack.

However, according to Dr. Hansen, of the Department of Plant Pathology of the University of California, this is purely physiological and caused by adverse weather conditions primarily, though it may be caused by a poor habitat.

A number of specimens of Monterey pines in the Berkeley Hills were examined and the pitch rings were found to be in the winter growth of 1935, when a heavy snow and severe freezing occurred.

None of these pitch regions were complete circles, but usually a quarter of a segment. They would cut off the supply of water and mineral salts to that part of the tree which they supplied and weaken the twigs in that portion for the winter season, or the season in which they occurred, but their effects wereenot permanently detrimental. However, they would weaken those portions of the tree affected to the extent that attacking insects could gain access without so much resistance by the tree as there would be if it were entirely normal.

All of the trees at Pt. Lobos that had died or showed signs of die-back also showed pitch areas in the rings. This would indicate that they were weakened to a certain extent when attacked by the Pityophthorus carmeli and P. nitidilus puncticollis.

Pityophthorus carmeli was by far the most numerous insec found in the twig tipssof the Monterey pine, though there were a number of P. nitidilus puncticollis. No other species noted at Pt. Lobos had any material effect on the pines, though there were several others present, including Graphisurus spectabilis, Ips radiata, Dendroctonus valens, and the channels of a Buprestid were noted.

Several hundred caterpillars of the Halisidota argentata were noted defoliating a number of on the tops of the cliffs near Carmel Bay. The trees attacked were otherwise normal at the time. This spring a further study of them will be made to see if any permanent damage was done, and if any of the beetles have attacked as a result of this attack.

The Pityophthorus carmeli and P. nitidilus puncticollis are polyomonus having a stellate type burrow with a central nuptial chamber and several (3-5) radiating egg tunnels. These egg tunnels follow the twig longitudinglly partly in the wood and partly in the bark, but the larval mines radiate transversely, girdling the twig. Their borings are so small that one family group could hardly girdle a large twig or branch, but several of them located around a twig or branch would completely girdle and kill it. These insects seldom occur more than 4 feet back form the twig tips.

Though there may be other insects contributory to the death of the Monterey pines, at Pt. Lobos, the P. carmeli was found to be the ultimate and most direct cause of death.

The present study is being conducted in the the Berkeley and Oakland Hills, Studies are being made in the Tunnel Road Canyon, along Harbord Drive, but most of it is carried on at Sequoia Park.

This work is just in its preliminary stages and will be carried on through the spring semester for further determinations.

All of these areas are plantations and most of the trees are near maturity, being even-aged stands in all instances.

The stand of Monterey pines in the Tunnel Road Canyon on the property of Mrs. Lila R. Havens is in much better condition than the other two stands studied.

The most conspicuous infestation was not that of insects, but a fungus gall, Cronartium coleosporioides, also known as Peridermium harknessii. This forms galls up to 4 or more inches in diameter, ultimately cutting off the food supply to the foliage beyond and causing its death. This also weakens the tree to the extent that insects may gain easy access without the resistance that they would encounter if the tree were normal. Pruning and burning the attacked limbs would take care of the situation.

The Monterey pine scale, Physokermes insignicolia, was found in this area but there was very little of it. The foliage was somewhat stunted where it occurred, but the needles had not died in any of the instances noted.

A few Pityophthorus were found on some of the twigs, causing them to turn brown, but in no instance were there enough of them to cause the death of more than a twig or two.

There are a number of trees bordering the lower side of Harbord Drive in the Oakland Hills near Buckeye Avenue that show bad signs of die-back, and two have already died and been cut down. At this particular locality Harbord Drive is cut in the side of a fairly steep hill and these trees have been planted at the toe of the fill from the street.

Under these circumstances all of the roots on the upper side have grown under the pavement where they were packed by the construction of the street and the heavy traffic that passes over it ddily. Very little water gets to these roots because the root hairs at their ends are all under the pavement and what water falls above and would normally seep into them is carried off in a drain, and the ground under the street is too solid to permit much seepage of the water that the drain has not taken off.

The effects of this seem quite obvious because the die-back that has occurred here as well as in Sequoia Park in trees that have been planted along streets, has always been on the sides of the trees facing the streets. In only a few cases was there die-back on the lower sides of the trees, and in these instances, the area covered was relatively small. All of the limbs that showed strong signs of die-back were infected with Pityophthorus.

The two trees that were mentioned as having died had Pityophthorus on all of the twig tips and Ips radiata on all of the lower limbs and tnunk, each contributing to their deaths.

Buckeye Avenue enters Harbord Drive at a very acute angle and is bordered by Monterey pines. A large pine stands at the apex of these two streets, one street being on the upper side of it, and the other c cut in below it. The only prominent die-back on this tree is on the side facing the apices of these two streets, thus indicating their iffect upon it.

There is quite a large grove of Monterey pines about a quarter of a mile up Harbord Drive opposite the intersection of Modoc Avenue. This, too, is private property and at present time a number of new homes are being built on it.

The trees bordering the Drive at the toe of the slope show die-back on the side facing the slope. Most of the trees back in the grove

are entirely normal, but there about 5 that have died and are standing.

The trees in the grove were planted so closs together that not all of them were able to survive. A number of them have been cut out, whether this was dome for thinning purposes or whether they died of i insect attack is not known at the moment.

However, these that have died and are still standing, did die of insect attack. Pityophthorus burrows were found on the twigs and the trunks were girdled by Ips radiata and Dendroctonus valens, and there was also some fungus growth in the open burrows, but obviously gained entrance after the bark had been open by the insects.

Though these trees were scattered throughout the grove and were presumably planted at the same time, they were much small than all of those surrounding, and appeared to be suppressed and weakened due to crowding. Thus weakened, they fell easy prey to the insects, whereas the normal ones surrounding them are still healthy.

A strange incident occurred to the trees that showed die-back bordering Harbord Drive in this grove and also to some of them in S Sequoia Park. When visited on November 21 the die-back had not showed any appreciable change in condition from previous weeks back to the time that they were first visited in the middle of September. But in one week's time, from November 21 to November 28, The die-back had increased about 25%. There have been no adverse weather conditions recently to cause a disturbance, conversely it has been so mild that it may have stimulated the activity of the insects. This question will be studied in detail in an attempt to determine the cause.

Sequoia Park has a situation which demands immediate attention to avoid the possibility of further spreading of the insect attacks.

One dying tree is located at the apices of the main road and the Park exit road. Seventy-five percent of the die-back is on the side facing this apices, and the death of the foliage has increased tremend-

ously in the past 3 weeks. At present rate of dying it will be dead before spring.

Two trees that are practically dead are located in the center of activity near the candy shop. A road runs directly over their roots and doubtlessly has a detrimental effect. They will soon be taken out and at that time samples of the roots will be obtained for study,

Nine other trees within a quarter of a mile radius of the Zoo are badly infected. In all of these cases they are growing under the same habitat conditions as their fellows and there was no apparent reason why they should be singled out for attack, except those that have been pruned. Some of these trees are on the south, north, and west facing slopes and show no signs of crowding or other abnormal conditions, $\frac{1}{2}$

However, there are others living under the same conditions that have had their lower limbs pruned up to 20 or 30 feet that were infected. The cuts of many of the pruned limbs had the pitch tubes of Ips radiata. Long streaks of pitch that had exuded from these borings was noted on the barks of the trees that were pruned. This pruning has given the insects an easy opening.

All of the trees infected in this immediate area, with 2 exceptions, had been pruned and no provision had been made to paint the fresh cuts to prevent insect in trusion.

The borings of Dendroctonus valens were noted near the bases of some of the trees, but they were minor in importance. Most of the damage has been done by the Pityophthorus and Ips radiata. Which attacks first or does the most damage has not been determined at the the present time, though it would appear that the Ips attacked the trees that have been pruned before the Pityophthorus due to the easy accessability, but there is no indication which will attack the undisturbed tees first.

This, and several other questions remain to be settled in the spring semester.

Cutting and burning all dead and dying trees, and pruning and burning the limbs of all of those lightly effected, to iliminate all of the possible breeding grounds of Pityophthorus, Ips and other insects to curb further infestation, is recommended. In the case of pruning, the cut ends should be painted or tared to stop the intrusion of insects through this easy opening.